TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: 0513/00548

U.S. APPLICATION NO. (If known, see 37 CFR 1.5): 09/600897

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/FR99/00030	11 January 1999	22 January 1998

TITLE OF INVENTION: PLATE CATALYTIC REACTOR

APPLICANT(S) FOR DO/EO/US: LEVY, William, SABIN, Dominique, GIROD, Christine

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. § 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.

5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).

7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the Annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
    ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter
16. ☐ Other items or information:

533 Rec'd PCT/PTO 24 JUL 2000

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09/600897	PCT/FR99/00030	0513/00548

☒ The following fees are submitted:

	CALCULATIONS	PTO USE ONLY
Basic National Fee (37 CFR 1.492(a)(1)-(5)):		
Search Report has been prepared by the EPO or JPO.....**$840.00**		
International preliminary examination fee paid to USPTO (37 CFR 1.482) **$670.00**		
No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2))....**$760.00**		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO....**$970.00**		
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)....**$96.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$840.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☒ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	**$130.00**	

Claims	Number Filed	Number Extra	Rate		
Total Claims	11 - 20 =	0	X **$18.00**	**$0.00**	
Independent Claims	1 - 3 =	0	X **$78.00**	**$0.00**	
Multiple dependent claim(s)(if applicable)			+ **$260.00**	**$0.00**	
TOTAL OF ABOVE CALCULATIONS =				**$970.00**	
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28)				**$**	
SUBTOTAL =				**$970.00**	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				**$0.00**	
TOTAL NATIONAL FEE =				**$970.00**	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				**$0.00**	
TOTAL FEES ENCLOSED =				**$970.00**	
				Amount to be: refunded	**$**
				charged	**$**

a. ☒ A check in the amount of $970.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. **22-0185** in the amount of $_____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Director is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **22-0185**. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b) must be filed and granted to restore the application to pending status

SEND ALL CORRESPONDENCE TO:

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	:	
William Levy et al.	:	
Serial No.: To be assigned	:	Art Unit: To be assigned
Filed: Herewith	:	Examiner: To be assigned
For: PLATE CATALYTIC REACTOR	:	Atty Docket: 0513/00548

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to initial examination, please amend the above-identified national phase application as follows.

IN THE CLAIMS

Please cancel claims 1-11 and add new claims 12-22 as follows:

12. Plate-type catalytic reactor, of the type comprising a leaktight enclosure of elongate form and a plate bundle arranged inside the said leaktight enclosure, creating with the latter a free space, and formed by a stack of metal plates furnished with corrugations, characterized in that the plates delimit between themselves:

a first series of channels forming a circuit for circulating a main fluid A formed of at least two components, said channels communicating with means of admission and of discharge of the main fluid A and containing a catalyst,

a second series of channels forming a circuit for circulating a cooling fluid B in a direction perpendicular to the direction of circulation of the main fluid A and communicating with means of admission and of discharge of the cooling fluid B,

a third series of channels forming a circuit for circulating a cooling fluid C in a direction perpendicular to the direction of circulation of the main fluid A and opposite to the direction of circulation of the cooling fluid B in the second series of channels, said channels of the third series communicating with means of admission and of discharge of the cooling fluid C and each channel of the first series being arranged between the channels of the second and of the third series respectively.

13. Catalytic reactor according to claim 12, characterized in that the means of admission of the main fluid A are formed by a pipe emerging into the free space created between the leaktight enclosure and the plate bundle and communicating with the inlet zones of the channels of the first series.

14. Catalytic reactor according to claim 12, characterized in that the means of discharge of the main fluid A are formed by a manifold arranged inside the leaktight enclosure and covering the outlet zones of the channels of the first series and by an outlet pipe connected to the said manifold.

15. Catalytic reactor according to claim 12, characterized in that the means of admission of the cooling fluid B into the second series of channels are formed by a manifold arranged inside the leaktight enclosure and covering the inlet zones of these channels and by an inlet pipe connected to said reactor and the means of discharge of this cooling fluid B are formed by a manifold arranged inside the leaktight enclosure and covering the outlet zones of the said channels and by an outlet pipe connected to said manifold.

16. Catalytic reactor according to claim 12, characterized in that the means of admission of the cooling fluid C into the third series of channels are formed by a

manifold arranged inside the leaktight enclosure and covering the inlet zones of these channels and by an inlet pipe connected to said manifold and the means of discharge of this cooling fluid C are formed by a manifold arranged inside the leaktight enclosure and covering the outlet zones of said channels and by an outlet pipe connected so said manifold.

17. Catalytic reactor according to claim 12, characterized in that the channels of the first series include a central part filled with catalyst and joined to means for filling said central part and to means for discharging the spent catalyst.

18. Catalytic reactor according to claim 17, characterized in that the means for filling with catalyst are formed by a manifold arranged at a first end of the central part of said channels of the first series and by an inlet pipe connected to said manifold and the means of discharge are formed by a manifold arranged at a second end of the central part opposite the first end and by an outlet pipe connected to said manifold.

19. Catalytic reactor according to claim 12, characterized in that the catalyst is held in the channels of the first series by gratings allowing the circulation of the main fluid A through the said catalyst.

20. Catalytic reactor according to claim 12, characterized in that the enclosure is provided with at least one rupture disc rated at a predetermined pressure.

21. Catalytic reactor according to claim 12, characterized in that the main fluid A consists of a mixture of air and ortho-xylene so as to obtain phthalic anhydride after passage through the catalyst.

22. Catalytic reactor according to claim 12, characterized in that the cooling fluid B or C consists of a mixture of molten salts.

REMARKS

The original claims have been cancelled and new claims have been added to eliminate the multiple dependency and to improve the format of the original claims. Each of claims 12-22 correspond to original claims 1-11. None of these amendments is believed to involve any new matter. Accordingly, it is respectfully requested that the foregoing amendments be entered, that the application as so amended receive an examination on the merits, and that the claims as now presented receive an early allowance.

Respectfully submitted,

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"Plate-type catalytic reactor"

The subject of the present invention is a plate-type catalytic reactor intended in particular for the production of phthalic anhydride.

It is known that for the production of certain fluids, such as for example phthalic anhydride, air and ortho-xylene are firstly mixed to produce a main fluid, then this main fluid is circulated through a catalytic reactor in the presence of a catalyst so as to produce the desired reaction.

Given the very strong isothermal reaction which occurs during the passage of the main fluid through the catalyst, this reaction can take place only in reactors which are cooled by an auxiliary fluid which usually consists of a mixture of molten salts.

Hitherto, for the production of this kind of fluid, use has been made of catalytic reactors formed by a leaktight enclosure inside which are arranged parallel tubes filled with catalyst.

The main fluid circulates through these tubes inside which the reaction occurs and the cooling fluid circulates outside the said tubes, between the latter and the inner wall of the enclosure.

The principal drawback of these tubular reactors resides in their dimensions since, for large units, the number of tubes rapidly becomes very great and the diameter of the apparatus excessive.

A plate-type catalytic reactor is also known which comprises a plate bundle delimiting a first circuit for circulating a main fluid formed of at least two components and a second circuit for circulating a secondary cooling fluid, the two fluids circulating counter-current-wise through the plate bundle.

The inlet means of each fluid into the corresponding circuits are formed by a multitude of small manifolds.

The inlet manifolds for the main fluid are filled with catalyst and include at least one injection header for each component of the said main fluid.

However, this arrangement is complex and the cost of such a catalytic reactor is high in view of the number of manifolds and of injection headers.

The purpose of the invention is to avoid these drawbacks by proposing a plate-type catalytic reactor offering low construction costs and a weight saving, whilst allowing an appreciable reduction in the pressure drops and a better coefficient of thermal exchange between the fluids.

The subject of the invention is therefore a plate-type catalytic reactor, of the type comprising a leaktight enclosure of elongate form and a plate bundle arranged inside the said leaktight enclosure, creating with the latter a free space, and formed by a stack of metal plates furnished with corrugations, characterized in that the plates delimit between themselves:

- a first series of channels forming a circuit for circulating a main fluid formed of at least two components, the said channels communicating with means of admission and of discharge of the main fluid and containing a catalyst,
- a second series of channels forming a circuit for circulating a cooling fluid in a direction perpendicular to the direction of circulation of the main fluid and communicating with means of admission and of discharge of the cooling fluid,
- and a third series of channels forming a circuit for circulating a cooling fluid in a direction perpendicular to the direction of circulation of the main fluid and opposite to the direction of circulation of the cooling fluid in the second series of channels, the said channels of the third series communicating with the means of admission and of discharge of the cooling fluid and each channel of the first series being arranged between the channels of the second and of the third series respectively.

According to other characteristics of the invention:

- the means of admission of the main fluid are formed by a pipe emerging into the free space created between the leaktight enclosure and the plate bundle and communicating with the inlet zones of the channels of the first series,

- the means of discharge of the main fluid are formed by a manifold arranged inside the leaktight enclosure and covering the outlet zones of the channels of the first series and by an outlet pipe connected to the said manifold,

- the means of admission of the cooling fluid into the second series of channels are formed by a manifold arranged inside the leaktight enclosure and covering the inlet zones of these channels and by an inlet pipe connected to the said manifold and the means of discharge of this cooling fluid are formed by a manifold arranged inside the leaktight enclosure and covering the outlet zones of the said channels and by an outlet pipe connected to the said manifold,

- the means of admission of the cooling fluid into the third series of channels are formed by a manifold arranged inside the leaktight enclosure and covering the inlet zones of these channels and by an inlet pipe connected to the said manifold and the means of discharge of this cooling fluid are formed by a manifold arranged inside the leaktight enclosure and covering the outlet zones of the said channels and by an outlet pipe connected to the said manifold,

- the channels of the first series include a central part filled with catalyst and joined to means for filling the said central part and to means for discharging the spent catalyst,

- the means for filling with catalyst are formed by a manifold arranged at a first end of the central part of the said channels of the first series and by an inlet pipe connected to the said manifold and the means of discharge are formed by a manifold

arranged at a second end of the said central part opposite the first end and by an outlet pipe connected to the said manifold,

- the catalyst is held in the channels of the first series by gratings allowing the circulation of the main fluid through the said catalyst,

- the leaktight enclosure is provided with at least one rupture disc rated at a determined pressure,

- the main fluid consists of a mixture of air and ortho-xylene so as to obtain phthalic anhydride after passage through the catalyst,

- the cooling fluid consists of a mixture of molten salts.

The invention will be better understood on reading the description which will follow, given by way of example and with reference to the appended drawings, in which:

- Fig. 1 is a longitudinal partially-sectioned diagrammatic view of a catalytic reactor in accordance with the invention,

- Fig. 2 is a partial perspective view of an end of the plate bundle of the catalytic reactor,

- Fig. 3 is a partial perspective view of the other end of the plate bundle of the catalytic reactor,

- Fig. 4 is a sectional view along the line 4-4 of Fig. 2.

Represented in Fig. 1 is a plate-type catalytic reactor intended in particular for the production of phthalic anhydride by passing a mixture of air and ortho-xylene in given proportions over a catalyst.

To do this, the catalytic reactor comprises a leaktight enclosure 1 of elongate form and of, for example, circular cross section.

This leaktight enclosure 1 is preferably arranged vertically.

Inside the leaktight enclosure 1 is placed a plate bundle designated overall by the reference 2 and of parallelepipedal general form.

This plate bundle 2 creates, with the enclosure 1, a free space 3.

As represented in Figs 2 and 3, the plate bundle 2 is formed by a stack of plates 4 which are parallel to one another and delimit a multitude of channels 10 which run longitudinally from one end to the other of the plate bundle 2.

In a conventional manner, the plates 4 made for example of stainless steel are held together by appropriate means and comprise smooth-surfaced edges and a central part furnished with corrugations, which are not represented, through which they are in contact one above the other and through which they delimit the channels 10.

In the exemplary embodiment represented in Figs 2 and 3, the plates 4 delimit between themselves a first series of channels 10A forming a circuit for circulating a main fluid A consisting of at least two components which are, for example, air and ortho-xylene.

The channels 10A are distributed over one channel 10 out of two in the plate bundle 2 and the fluid A circulates through these channels 10A transversely with respect to the longitudinal axis of the said plate bundle 2.

For this purpose and as represented in Fig. 2, a lateral face of the plate bundle 2 comprises inlet zones 12A for the main fluid A whilst the openings of one channel out of two are closed by shutoff members 11 formed for example by tongues running along the entire length of the said lateral face of the plate bundle 2.

Likewise, the other lateral face, represented in Fig. 3, of the plate bundle 2 comprises outlet zones 13A for the main fluid A after passing through the channels 10A whilst one channel 10 out of two is closed by shutoff members 11 formed by tongues running along the entire length of the said lateral face of the plate bundle 2.

The plates 4 likewise delimit a second series of channels 10B forming a circuit for circulating a cooling fluid B in a direction perpendicular to the direction of circulation of the fluid A.

The channels 10B are distributed over one channel 10 out of three in the plate bundle 2 and one, represented in Fig. 2, of the end faces of this plate bundle 2 comprises inlet zones 12B for the cooling fluid B, whilst the other lateral face, represented in Fig. 3, of the plate bundle 2 comprises outlet zones 13B for this cooling fluid.

The cooling fluid consists for example of a mixture of molten salts.

The plates 4 also delimit between themselves a third series of channels 10C forming a circuit for circulating a cooling fluid C in a direction perpendicular to the direction of circulation of the main fluid A in the channels 10A and opposite to the direction of circulation of the cooling fluid B in the channels 10B.

The channels 10C are distributed over one channel 10 out of three in the plate bundle 2 and one, represented in Fig. 3, of the end faces of this plate bundle 2 comprises inlet zones 12C for the cooling fluid C, whilst the other end face, represented in Fig. 2, of the plate bundle 2 comprises outlet zones 13C for this cooling fluid C.

The cooling fluid C likewise consists of a mixture of molten salts.

By virtue of this arrangement, each channel 10A of the first series for circulating the main fluid A is arranged between a channel 10B of the second series and a channel 10C of the third series for circulating the cooling fluids, thereby making it possible to obtain optimal cooling of the main fluid A.

Thus, on one of the end faces of the plate bundle 2 (Fig. 2) are created inlet zones 12B for the cooling fluid B and outlet zones 13C for the cooling fluid C, and on the other of these end faces of the plate bundle 2 (Fig. 3) are created outlet zones 13B

for the cooling fluid B and inlet zones 12C for the cooling fluid C.

On the end faces of the plate bundle 2, the ends of the channels 10, which are situated between the inlet zones 12B and the outlet zones 13C or the inlet zones 12C and the outlet zones 13B for each cooling fluid B and C, are closed by shutoff members 11.

The shutoff members 11 of the channels 10 of the lateral faces and of the end faces of the plate bundle 2 are formed, for example, by tongues welded to the edges of the corresponding plates 4 or by folded-over edges of the plates 4, the ends of which are welded together.

The catalytic reactor also includes means of admission and of discharge of the main fluid A into the channels 10A and respectively means of admission and of discharge of the cooling fluid B into the channels 10B and means of admission and of discharge of the cooling fluid C into the channels 10C.

As represented in Fig. 1, the means of admission of the main fluid A into the inlet zones 12A of the channels 10A are formed by a pipe 20 emerging in the free space 3 created between the leaktight enclosure 1 and the plate bundle 2 and communicating with the inlet zones 12A of the channels 10A of the first series.

The main fluid A spreads inside the leaktight enclosure 1 and the overpressure thus generated holds the plate bundle 2 in compression.

The means of discharge of the main fluid A after passing through the channels 10A are formed by a manifold 21 arranged inside the enclosure 1 and covering the outlet zones 13A of the channels 10A of the first series and by an outlet pipe 22 connected to the said manifold.

The means of admission of the cooling fluid B into the second series of channels 10B of the plate bundle 2 are formed by a manifold 23 arranged inside the leaktight enclosure 1 covering the inlet zones 12B

of these channels 10B and by an inlet pipe 24 connected to the manifold 23.

The means of discharge of this cooling fluid B are formed by a manifold 25 arranged inside the leaktight enclosure 1 and covering the outlet zones 13B of the channels 10B and by an outlet pipe 26 connected to this manifold 25.

The means of admission of the cooling fluid C into the third series of channels 10C of the plate bundle 2 are formed by a manifold 27 arranged inside the leaktight enclosure 1 and covering the inlet zones 12C of these channels 10C and by an inlet pipe 28 connected to the said manifold 27.

Finally, the means of discharge of the cooling fluid C of the channels 10C are formed by a manifold 29 arranged inside the leaktight enclosure 1 and covering the outlet zones 13C of the channels 10C and by an outlet pipe 30 connected to this manifold 29.

In the exemplary embodiment represented in Fig. 1, the manifold 23 for admitting the cooling fluid B into the channels 10B is situated facing the manifold 27 for admitting the cooling fluid C into the channels 10C and the manifold 25 for discharging the fluid B from the channels 10B is situated facing the manifold 29 for discharging the cooling fluid C from the channels 10C.

Moreover, the channels 10A for circulating the main fluid A contain particles 35 of catalyst so as to engender the desired reaction upon the passage of the main fluid A composed of air and of ortho-xylene so as to collect, through the manifold 21 and the outlet pipe 22, phthalic anhydride.

Preferably and as represented in Fig. 4, the particles 35 of catalyst are arranged in the central part of the channels 10A and this central part is joined to means for filling and means for discharging the particles of spent catalyst.

The particles 35 of catalyst are held on each side of the central part of the channels 10A by a

grating 36 which runs along the entire length of the plate bundle 2. The gratings 36 have meshes which are fine enough to hold these particles 35 of catalyst, whilst allowing the passage through these particles 35 of the main fluid A.

As represented in Fig. 1, the means for filling with particles 35 of catalyst in the channels 10A are formed by a manifold 31 arranged on an end face of the plate bundle 2 and preferably at the top part of the catalytic reactor and by a pipe 32 connected to the said manifold 31.

The means for discharging the particles 35 of catalyst are formed by a manifold 33 arranged on the other end face of the plate bundle 2 and preferably at the bottom part of the catalytic reactor and by an outlet pipe 34 connected to the said manifold 33.

The production of phthalic anhydride entails risks of explosion in the vicinity of the inlet of the main fluid composed of air and of ortho-xylene and the leaktight enclosure is, therefore, furnished with at least one rupture disc 37 amply dimensioned as a function of the conditions of explosion so as to contain the increase in pressure within determined limits and for example below 10 bar inside the leaktight enclosure 1.

The main fluid A composed of a mixture of air and ortho-xylene is introduced through the inlet pipe 20 into the leaktight enclosure 1 and enters the channels 10A through the inlet zones 12A created on the lateral face of the plate bundle 2.

This main fluid A therefore circulates inside the channels 10A, then crosses the particles 35 of catalyst so as to obtain the desired reaction and the phthalic anhydride thus produced exits the channels 10A through the outlet zones 13A created on the other lateral face of the plate bundle 2 and exits the catalytic reactor through the manifold 21 and the outlet pipe 22.

Simultaneously with the circulation of the main fluid A, the cooling fluid B composed of a mixture of molten salts is injected into the set of channels 10B through the inlet pipe 24, the manifold 23 and the inlet zones 12B and spreads out over the entire surface of these channels 10B, then exits the catalytic reactor through the outlet zones 13B, the manifold 25 and the outlet pipe 26.

Likewise, the cooling fluid C composed of a mixture of molten salts is injected into the channels 10C of the plate bundle 2 through the inlet pipe 28, the manifold 27 and the inlet zones 12C, then spreads out over the entire surface of these channels 10C and exits the catalytic reactor through the outlet zones 13C, the manifold 29 and the outlet pipe 30.

Thus, the main fluid A is cooled during its passage through the plate bundle 2 by the cooling fluids B and C which circulate on either side of the channels 10A intended for the circulation of the main fluid A.

After a certain time of use, the particles 35 of spent catalyst are discharged under gravity from the channels 10A through the manifold 33 and the outlet pipe 34 and new particles 35 of catalyst are introduced into these channels 10A through the manifold 31 and the inlet pipe 32.

Preferably, each end face of the plate bundle 2 exhibits a trapezoidal form so as to allow, at the centre, the installation of the manifolds 31 and 33 for the flow of the particles of catalyst and, on the sides, the installation of the inlet manifolds 23 and 27 for the cooling fluids and the outlet manifolds 25 and 29 for these cooling fluids.

The circulation of the main fluid A and of the cooling fluids B and C cross-current-wise and the circulation of the fluids B and C counter-current-wise with respect to one another makes it possible to obtain an appreciable reduction in the pressure drops and a

better coefficient of thermal exchange between the fluids.

Finally, this arrangement has the advantage of reducing the construction costs and of obtaining a weight saving.

CLAIMS

1. Plate-type catalytic reactor, of the type comprising a leaktight enclosure (1) of elongate form and a plate bundle (2) arranged inside the said leaktight enclosure (1), creating with the latter a free space (3), and formed by a stack of metal plates (4) furnished with corrugations, characterized in that the plates (4) delimit between themselves:

- a first series of channels (10A) forming a circuit for circulating a main fluid A formed of at least two components, the said channels (10A) communicating with means of admission (20) and of discharge (21, 22) of the main fluid A and containing a catalyst (35),

- a second series of channels (10B) forming a circuit for circulating a cooling fluid B in a direction perpendicular to the direction of circulation of the main fluid A and communicating with means of admission (23, 24) and of discharge (25, 26) of the cooling fluid B,

- a third series of channels (10C) forming a circuit for circulating a cooling fluid C in a direction perpendicular to the direction of circulation of the main fluid A and opposite to the direction of circulation of the cooling fluid B in the second series of channels (10B), the said channels (10C) of the third series communicating with means of admission (27, 28) and of discharge (29, 30) of the cooling fluid C and each channel of the first series (10A) being arranged between the channels (10B, 10C) of the second and of the third series respectively.

2. Catalytic reactor according to Claim 1, characterized in that the means of admission of the main fluid A are formed by a pipe (20) emerging into the free space (3) created between the leaktight enclosure (1) and the plate bundle (2) and communicating with the inlet zones (12A) of the channels (10A) of the first series.

3. Catalytic reactor according to Claim 1, characterized in that the means of discharge of the main fluid A are formed by a manifold (21) arranged inside the leaktight enclosure (1) and covering the outlet zones (13A) of the channels (10A) of the first series and by an outlet pipe (22) connected to the said manifold (21).

4. Catalytic reactor according to Claim 1, characterized in that the means of admission of the cooling fluid B into the second series of channels (10B) are formed by a manifold (23) arranged inside the leaktight enclosure (1) and covering the inlet zones (12B) of these channels (10B) and by an inlet pipe (24) connected to the said reactor and the means of discharge of this cooling fluid B are formed by a manifold (25) arranged inside the leaktight enclosure (1) and covering the outlet zones (13B) of the said channels (10B) and by an outlet pipe (26) connected to the said manifold (25).

5. Catalytic reactor according to Claim 1, characterized in that the means of admission of the cooling fluid C into the third series of channels (10C) are formed by a manifold (27) arranged inside the leaktight enclosure (1) and covering the inlet zones (12C) of these channels (10C) and by an inlet pipe (28) connected to the said manifold (27) and the means of discharge of this cooling fluid C are formed by a manifold (29) arranged inside the leaktight enclosure (1) and covering the outlet zones (13C) of the said channels (10C) and by an outlet pipe (30) connected to the said manifold (29).

6. Catalytic reactor according to Claim 1, characterized in that the channels (10A) of the first series include a central part filled with catalyst (35) and joined to means (31, 32) for filling the said central part and to means (33, 34) for discharging the spent catalyst (35).

7. Catalytic reactor according to Claim 6, characterized in that the means for filling with

catalyst (35) are formed by a manifold (31) arranged at a first end of the central part of the said channels (10A) of the first series and by an inlet pipe (32) connected to the said manifold (31) and the means of discharge are formed by a manifold (33) arranged at a second end of the central part opposite the first end and by an outlet pipe (34) connected to the said manifold (33).

8. Catalytic reactor according to Claim 1 or 6, characterized in that the catalyst (35) is held in the channels (10A) of the first series by gratings (36) allowing the circulation of the main fluid A through the said catalyst (35).

9. Catalytic reactor according to Claim 1, characterized in that the enclosure (1) is provided with at least one rupture disc (37) rated at a determined pressure.

10. Catalytic reactor according to any one of the preceding claims, characterized in that the main fluid A consists of a mixture of air and ortho-xylene so as to obtain phthalic anhydride after passage through the catalyst (35).

11. Catalytic reactor according to one of Claims 8 to 9, characterized in that the cooling fluid B or C consists of a mixture of molten salts.

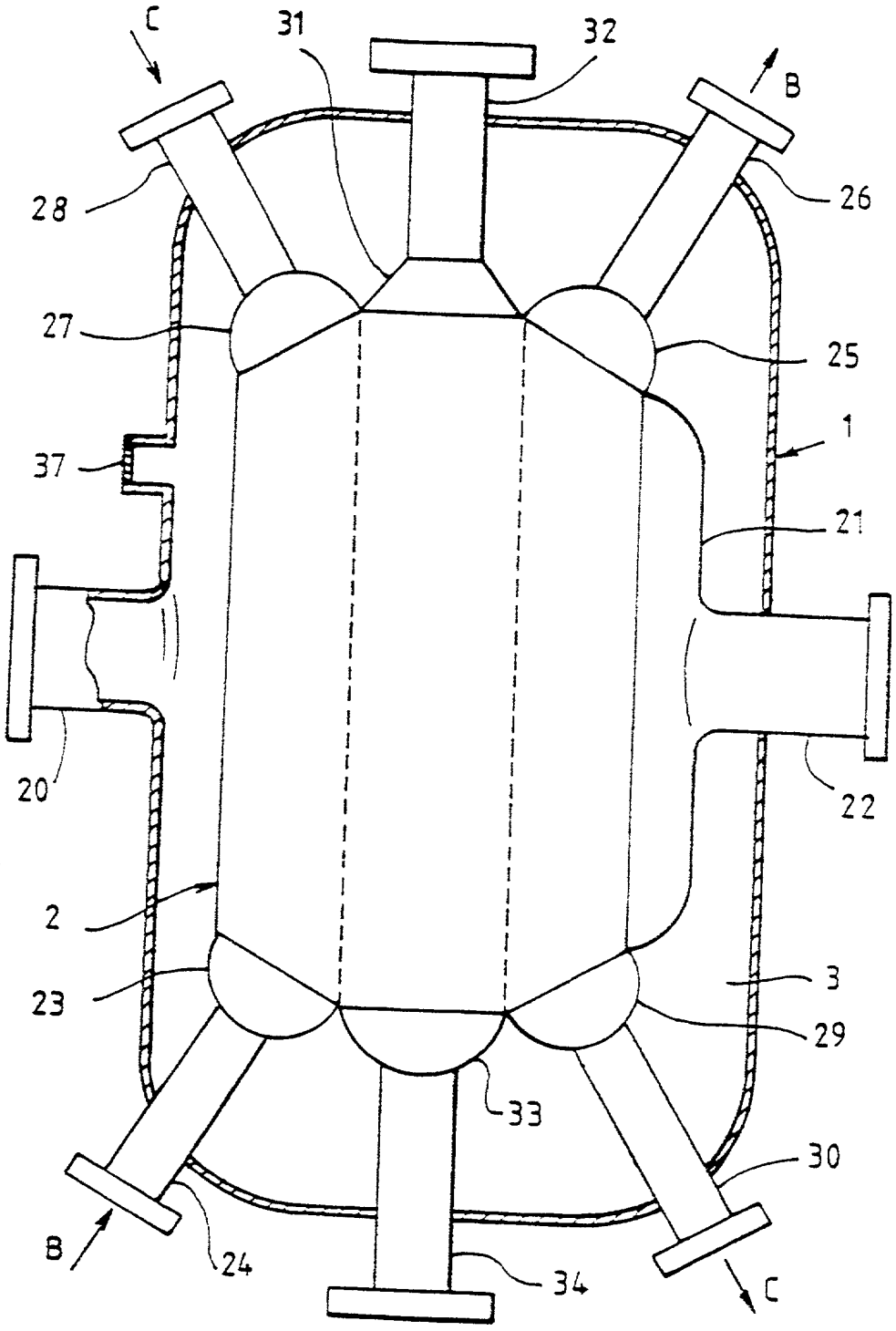

FIG.1

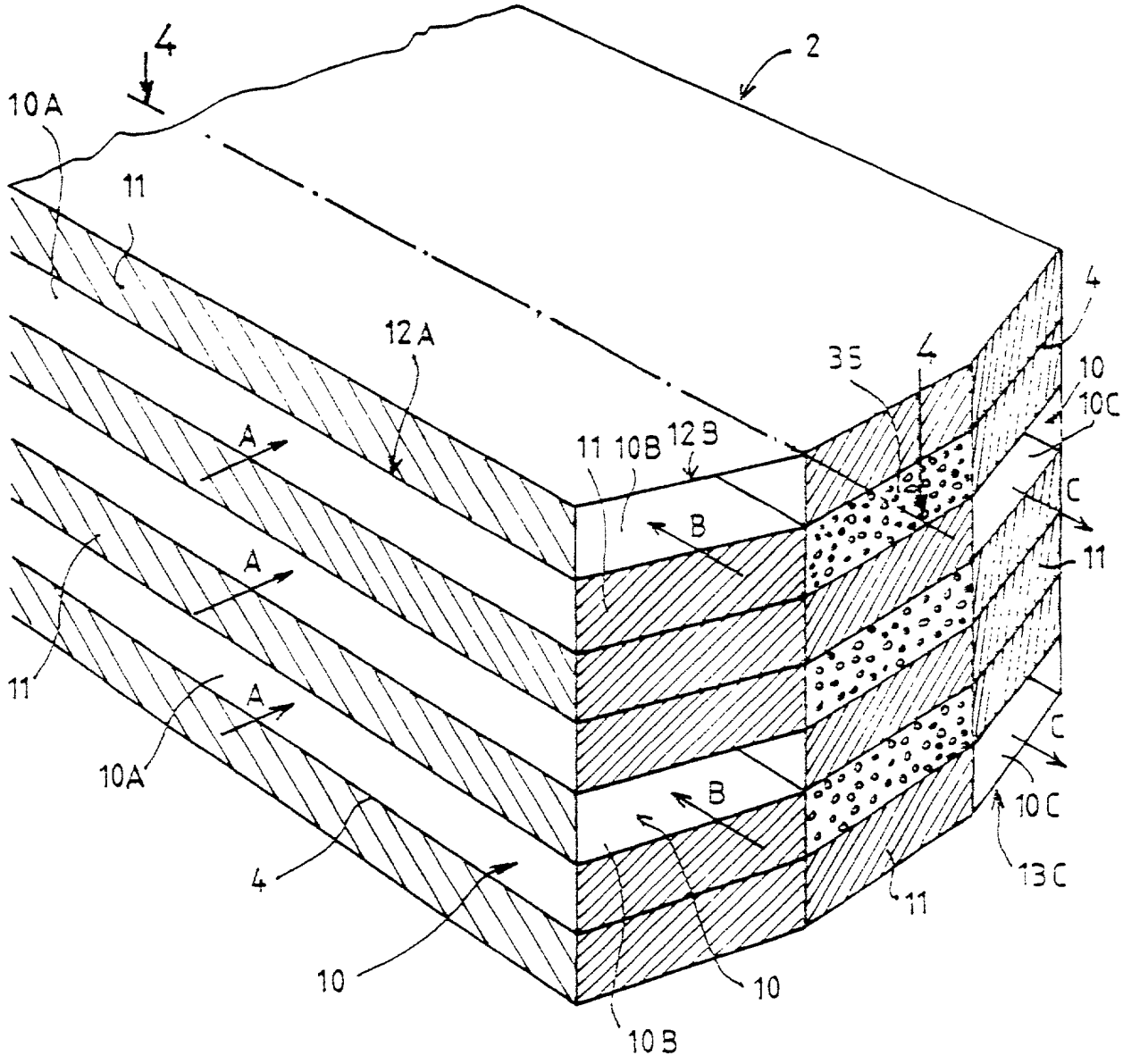
4
2
10A
11
12A
35
4
10
10C
A
11 10B
12B
B
C
11
A
11
A
10A
B
4
10C
13C
11
10
10
10B

FIG.2

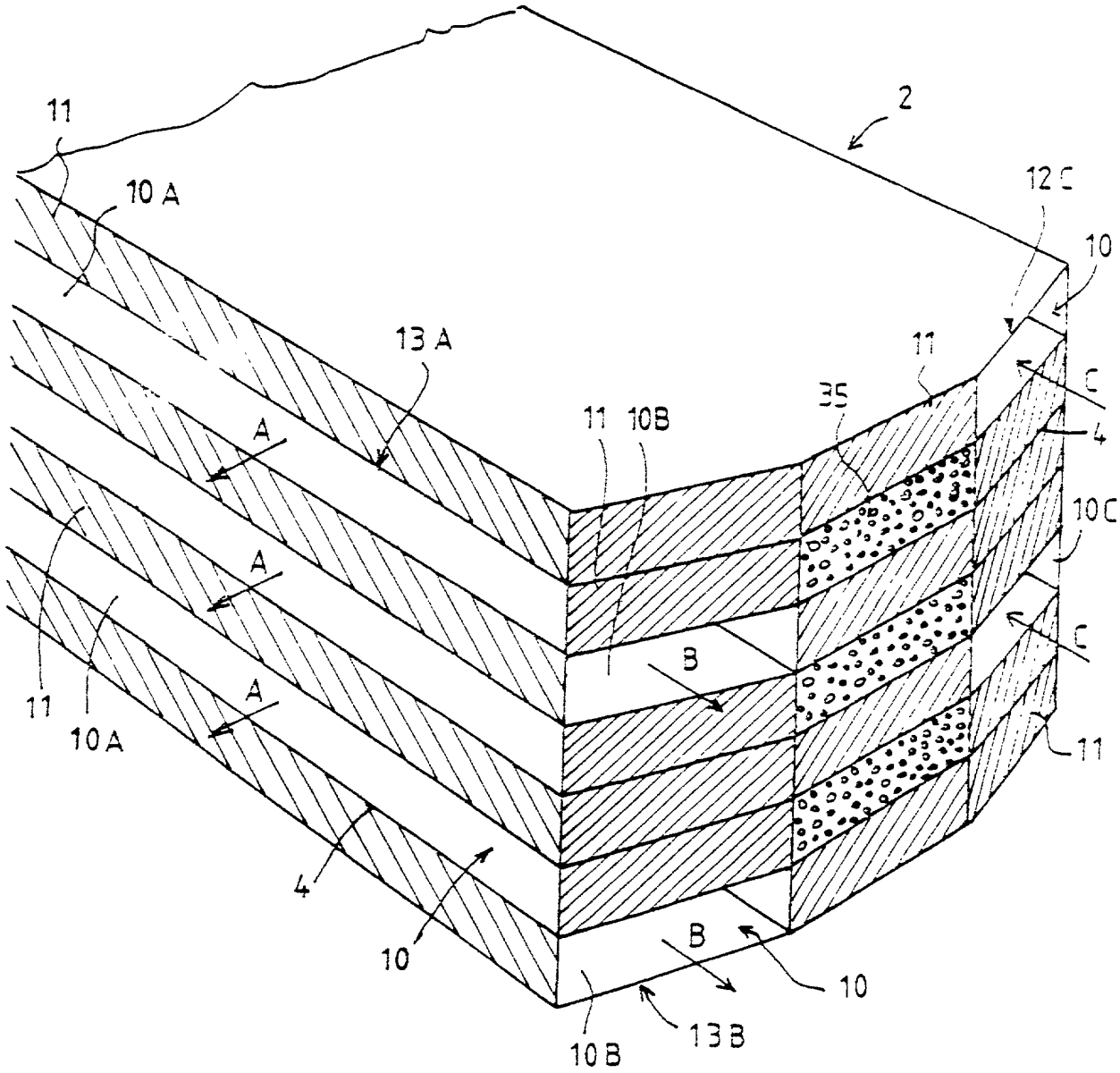
11
2
10 A
12 C
10
13 A
11
35
11 10B
C
4
A
10C
A
B
C
A
11
10 A
11
4
10
B
10
13 B
10 B

FIG.3

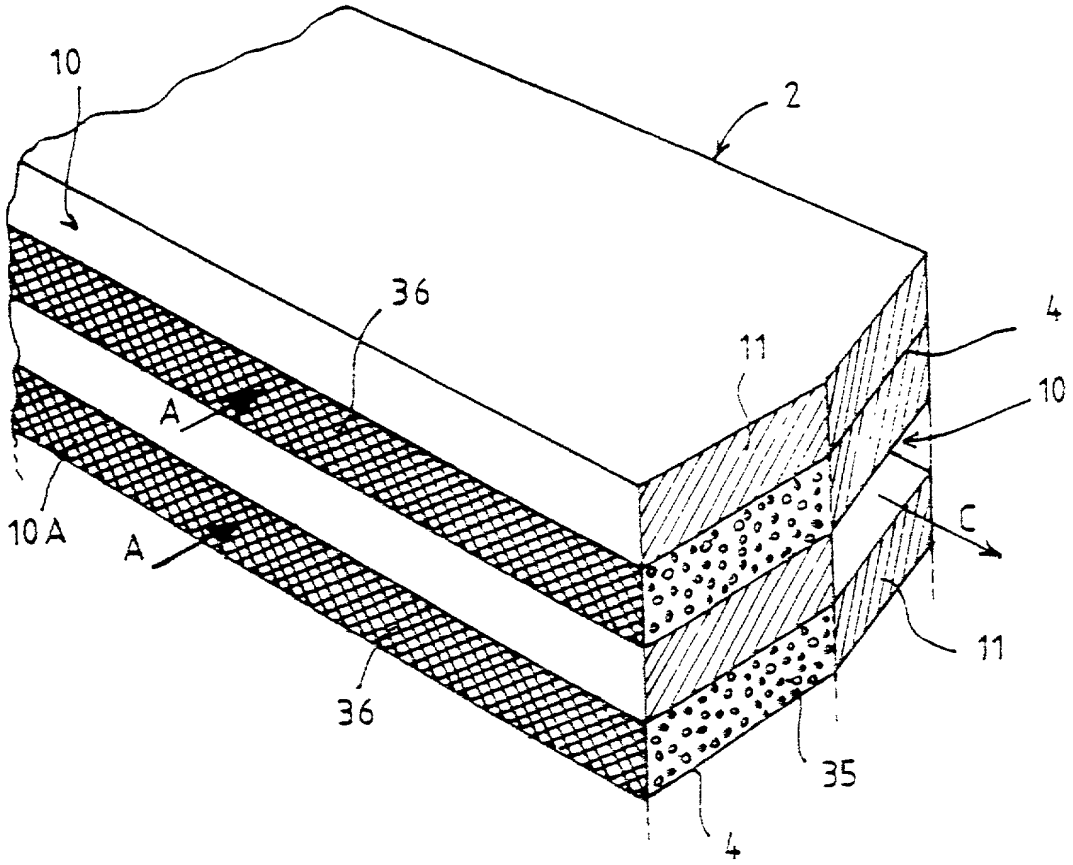

FIG.4

Packinox 98006 72

(No fac remp.)

DECLARATION FOR PATENT APPLICATION

As a below-named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: "Plate-type catalytic reactor"

the specification of which: (check one)

[ ] is attached hereto. [X] was filed on 24/07/2000 as United States Patent Application Serial No. or PCT International Application Number 600 897, and was amended on 19 (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with 37 CFR § 1.56(a).

Prior Foreign Application(s): I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate listed below, or § 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

(Application No.)	(Country)	(Day/Month/Year Filed)	Priority Claimed
98 00 672	FRANCE	22 January 1998	[X] Yes [ ] No
			[ ] Yes [ ] No
			[ ] Yes [ ] No

I hereby claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below.

Application No.	Filing Date

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by 35 U.S.C. § 112, first paragraph, I acknowledge the duty to disclose material information as defined in 37 CFR § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(U.S. Application Serial No.)	(U.S. Filing Date)	(Status--patented, pending, abandoned)
PCT/FR99/00030	January 11, 1999	Pending

I hereby appoint Elliott I. Pollock, Registration No. 16,906; George Vande Sande, Registration No. 17,276; Burton A. Amernick, Registration No. 24,852; Stanley B. Green, Registration No. 24,351; Richard Wiener, Registration No. 18,741; Townsend M. Belser, Jr., Registration No. 22,956; Morris Liss, Registration No. 24,510, Martin Abramson, Registration No. 25,787; George R. Pettit, Registration No. 27,369, Elzbieta Chlopecka, Registration No. 32,767; Eric J. Franklin, Registration No. 37,134; and Jeffri A. Kaminski, Reg. No. 42,709, my attorneys with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

Send Correspondence and Direct Telephone Calls to:

(202) 331-7111

Pollock, Vande Sande & Amernick, R.L.L.P.
P.O. Box 19088
Washington, D.C. 20036-3425 U.S.A.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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DECLARATION FOR PATENT APPLICATION

Page Two

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Full name of fourth joint inventor (if any): _____

Inventor's Signature _____ Date _____

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Citizenship _____

Post Office Address _____

Full name of fifth joint inventor (if any): _____

Inventor's Signature _____ Date _____

Residence Address _____

Citizenship _____

Post Office Address _____

Full name of sixth joint inventor (if any): _____

Inventor's Signature _____ Date _____

Residence Address _____

Citizenship _____

Post Office Address _____

Full name of seventh joint inventor (if any): _____

Inventor's Signature _____ Date _____

Residence Address _____

Citizenship _____

Post Office Address _____

Full name of eighth joint inventor (if any): _____

Inventor's Signature _____ Date _____

Residence Address _____

Citizenship _____

Post Office Address _____